REMARKS

Claims 1-12 and 25 are currently pending in the present application and are presently under consideration. Claim 4 has been amended herein to cure minor informalities, and is for clarification purposes only. Such amendment does not narrow the scope of this respective claim. All pending claims with status identifiers are found at pages 3-6.

Applicants' representative acknowledges with appreciation the Examiner's indication that claims 10-12 would be allowable if recast in independent form to recite all limitations of respective base claims and any intervening claims. However, it is believed such amendments are not necessary in view of the amendments herein and the deficiencies discussed *infra* of the cited art *vis a vis* applicant's claimed invention.

Favorable reconsideration is requested in view of the comments below.

I. Rejection of Claim 1 under 35 U.S.C. §103(a)

Claim 1 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Eriguchi, *et al.* (US 6,113,733) in view of Su (US 6,486,492). Reconsideration and allowance of claim 1 is respectfully requested for at least the following reasons. Eriguchi, *et al.* and Su, individually or in combination, do not teach or suggest all the claim limitations of the subject invention.

> In order to establish a prima facie case of obviousness, the teaching or suggestion to make the claim modification *must be found in the cited art,* not based on the applicant's disclosure. *In re Vaeck,* 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). Furthermore, the mere fact that the reference can be modified does not render the modification obvious unless the cited art also suggests the desirability of the modification. *In re Mills,* 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

In particular, and as will be discussed in detail below, neither Eriguchi, *et al.* nor Su teach or suggest ***...directing a single beam of light onto one or more gratings...*** and thereafter ***...measuring one or more etching parameters from light reflected from the one or more gratings.*** Eriguchi, *et al.* teaches a system for detecting defects in a semiconductor region *via* emitting *two light beams* - an exciting light and a monitoring light.

The exciting light is utilized to excite carriers in the semiconductor region, thereby generating an electric field. The measuring light is directed at the same semiconductor region and reflects from the semiconductor region to a capturing mechanism. The reflectance of the monitoring light alters in the presence and absence of the exciting light. Therefore, the exciting light is intermittently emitted, and measurements of reflectance of the monitoring light are taken during instances the exciting light is applied as well as when the exciting light is not applied. A "change rate" is thereafter calculated based upon alteration in reflectance of the monitoring light in the presence and absence of the exciting light (*See* col. 6, lines 8-36). Such alteration of reflectance can thereafter be utilized to determine number of defects in the semiconductor region, thickness of film in the semiconductor region, and depth of gratings in the semiconductor region.

However, utilization of two light sources (*e.g.*, an exciting light source and a monitoring light source) increases complexity and cost of an optical semiconductor monitoring system. Alternatively, Eriguchi, *et al.* discloses utilizing a single light source and thereafter splitting the light source into an exciting beam and a monitoring beam. Such configuration requires at least a chopper, a beam splitter, and multiple mirrors, thereby again increasing cost and complexity of the monitoring system. Moreover, monitoring semiconductor parameters *via* two beams of light increases possibility of error due to a plurality of calculations, mechanisms, and variables. For example, in an instance that the exciting light and monitoring light are not directed at an identical semiconductor region, the change rate calculated will not be accurate. Furthermore, a monitoring device must be precisely timed to effectuate accurate monitoring of a change rate, as the exciting light is disclosed as being emitted at a frequency as high as 1Khz (*See* col. 5, lines 66-67). For instance, the change rate can be calculated when the exciting light is not at peak intensity, thereby corrupting change rate data and skewing output results.

In contrast, the present invention as recited in the subject claim employs ***a system for directing a single beam of light onto one or more gratings...***, and thereafter ***measuring one or more etching parameters from light reflected from the one or more gratings.*** The present invention is a system for monitoring and controlling etch parameters that mitigates the above expressed deficiencies of Eriguchi, *et al.* ***A single beam of light*** is reflected off at

least a portion of a semiconductor grating, and wave properties of the reflected light are analyzed to determine various etching parameters, such as horizontal etch rate, vertical etch rate, etch-rate percent uniformity and isotropic versus anisotropic effects. Moreover, the ***single beam of light*** can facilitate monitoring width of etch lines to determine whether acceptable critical dimensions can be achieved. The invention as recited in the subject claim can determine such etching parameters without the expense of multiple mirrors, choppers, various light sources, *etc.* Furthermore, the present invention requires less calculation, thereby alleviating concerns of rounding errors and other similar errors that are associated with multiple calculations.

Su discloses a microscopy system utilized to monitor etching parameters, and then utilizing such monitored parameters as feed-forward information to facilitate control of a semiconductor manufacturing process. As Su utilizes microscopy monitor parameters, Su does not teach or suggest ***a single beam of light*** utilized to ***measure one or more etching parameters.*** The microscopy techniques as taught in Su are expensive, time consuming, and can be destructive when compared to the optical system of the subject invention.

In view of at least the above, it is readily apparent that neither Eriguchi, *et al.* nor Su, alone or in combination, teach or suggest the subject invention as recited in independent claim 1. This rejection should be withdrawn.

II. Rejection of Claims 2-6 and 8 under 35 U.S.C. §103(a)

Claims 2-6 and 8 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Eriguchi, *et al.* and Su, and further in view of Xu, *et al.*(US 6,483,580). Withdrawal of this rejection is respectfully requested for at least the following reasons. Claims 2-6 and 8 depend from independent claim 1. Claim 1 is believed to be in condition for allowance, rendering the subject rejection moot. Therefore, this rejection should be withdrawn.

III. Rejection of Claims 7 and 9 under 35 U.S.C. §103(a)

Claims 7 and 9 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Eriguchi, *et al.*, Su, Xu, *et al.*, and further in view of Ko, *et al.* (US 6,117,791). Withdrawal of this rejection is respectfully requested for at least the following reasons.

Claims 7 and 9 depend from independent claim 1. Claim 1 is believed to be in condition for allowance, rendering this rejection moot. Therefore, the subject rejection should be withdrawn.

IV. Rejection of Claim 25 under 35 U.S.C. §103(a)

Claim 25 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Jahns (US 5,711,843) in view of Su and further in view of Xu. Reconsideration and allowance of this claim is respectfully requested for at least the following reasons. Neither Jahns, Su, nor Xu teaches or suggests combining all elements of the subject claim.

> Absent some teaching or suggestion in the prior art to combine elements, it is insufficient to establish obviousness by claiming that the separate elements of the invention existed in the prior art. *Arkie Lures Inc. v. Gene Larew Tackle Inc.*, 43 USPQ2d 1294, 1297 (Fed. Cir. 1997).

More particularly, the cited references do not teach or suggest ***partitioning a wafer into... grid blocks*** and ***sensing the acceptability of etching in... grid blocks via scatterometry.*** Jahns teaches monitoring process environment properties, such as temperature of plasma, gas flow rate, gas pressure, *etc.* (*See* col. 3 lines 38-44). One or more of such sensed environmental properties are relayed to a process condition monitor, which determines whether any of such properties (or a combination of properties) renders the process defective. Utilizing the invention as disclosed in Jahns, an etching process is labeled as defective based upon parameters within the process chamber, and not based upon parameters of a wafer being processed. Furthermore, the system of Jahns cannot determine portions of a wafer that are defective. Rather, an entire wafer would be deemed defective even in an instance that only a small portion of such wafer was actually defective and could be repaired. Moreover, upon determining that environmental properties are such that etching the wafer is acceptable, etch rates (and various other process parameters) are *estimated* by a classifier based on the environmental properties. Such an arrangement does not facilitate control of etch components particular to grid

cells of a wafer. Rather, the processes are controlled for the entire wafer, thus not facilitating achievement of critical dimensions throughout the entirety of the wafer.

Su teaches exposing a wafer to create a focus-exposure matrix, and thereafter examining each matrix cell with a convention CD-SEM scan. Su does not teach or suggest utilizing ***scatterometry means*** for ***sensing the acceptability of etching in... grid blocks.*** Xu discloses utilizing scatterometry techniques to measure one or more parameters of a diffracting structure. Xu does not teach or suggest utilizing ***scatterometry means*** for ***sensing acceptability of etching in a grid*** of a wafer.

The cited prior art references do not exhibit benefits obtained *via* utilizing the invention as recited in the subject claim to control an etching process on a portion of a wafer. Partitioning of the wafer into a grid enables accurate determination of a location in which control of an etching component is required. For example, *via* monitoring individual grid cells, an etching component can be controlled accordingly to facilitate achievement of desirable critical dimensions. Furthermore, the present invention enables *in situ* monitoring and control of an etching component pertaining to a particular grid cell without the expense, complexity, and risk associated with CD-SEM scans. Moreover, etch rates and various other process parameters can be directly measured and controlled, rather than predicting such etch rates based upon processing environment properties such as temperature and gas flow as disclosed in Jahn.

In view of the foregoing, it is respectfully submitted that no teaching or suggestion to combine Jahn, Su, and Xu exists in the cited references. This rejection should be withdrawn.

V. Conclusion

The present application is believed to be condition for allowance in view of the above comments and amendments. A prompt action to such end is earnestly solicited.

In the event any fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063.

Should the Examiner believe a telephone interview would be helpful to expedite favorable prosecution, the Examiner is invited to contact applicants' undersigned representative at the telephone number listed below.

Respectfully submitted,

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